



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Confirmation No.: 7012

In re Appellants : Jiyang Yan  
U.S. Serial No. : 10/600,420  
Filed : June 19, 2003  
Examiner : Patricia L. Hailey  
Group Art Unit : 1755  
For : METHODS FOR MAKING A CATALYTIC  
ELEMENT, THE CATALYTIC ELEMENT MADE  
THEREFROM, AND CATALYZED PARTICULATE  
FILTERS

**APPEAL BRIEF**

Mail Stop  
Appeal Brief – Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**I. REAL PARTY IN INTEREST**

The present application is assigned to UMICORE AG & CO. KG, a corporation of Germany having a place of business at Rodenbacher Chaussee 4, Hanau, GERMANY 63457.

**II. RELATED APPEALS AND INTERFERENCES**

To the best of the undersigned's knowledge, no other appeals or interferences will directly affect, will be directly affected by, or will have a bearing on, the Board's decision in this appeal.

### **III. STATUS OF CLAIMS**

Claims 1, 3-8 and 13-16 remain pending in the application, and are under appeal. These claims are attached to this Brief, as required by 37 CFR 1.192(c)(9).

### **IV. STATUS OF AMENDMENTS**

A Response to Office Action was filed on January 16, 2007. A Final Rejection was mailed on April 5, 2007. A Notice of Appeal was filed on September 27, 2007.

### **V. SUMMARY OF CLAIMED SUBJECT MATTER**

Claim 1 is directed to a method for making a diesel particulate filter, involving:

providing a wall-flow substrate having an inlet wall surface and an outlet wall surface (see, e.g., Figure 1 and paragraphs [0026] and [0027]),

applying a promoter oxide compound onto refractory inorganic oxide particles to form supported promoter particles (see, e.g., paragraph [0021]),

impregnating the supported promoter particles with a noble metal catalyst to form catalyst-bearing particles (see, e.g., paragraph [0022]),

sizing the catalyst-bearing particles and

applying the sized catalyst-bearing particles to the inlet wall surface of the wall-flow substrate and not to the outlet wall surface (see, e.g., paragraphs [0027] and [0028]).

The wall-flow substrate has an inlet channel, an outlet channel and a porous wall separating the inlet channel and the outlet channel, the porous wall having an inlet wall surface adjacent the inner channel and an outlet wall surface adjacent the outer channel (see, e.g., Figure 1 and paragraphs [0026] and [0027]).

The wall-flow substrate is characterized by a thickness between the inlet wall surface and the outlet wall surface and by pores having an average pore size of between 5 micrometers and 500 micrometers (see, e.g., paragraph [0025], lines 7-8).

The promoter oxide compound is applied onto the refractory inorganic oxide particles by forming a first slurry of the refractory inorganic oxide particles dispersed in a solution containing a precursor of the promoter oxide compound and calcining to form the promoter oxide compound, which is then deposited onto the refractory inorganic oxide particles to form the supported promoter particles (see, e.g., paragraph [0021]). The sized catalyst-bearing particles

have an average particle diameter of about 2 micrometers to about 10 micrometers, with the particle size being about 10% to 80% of the average pore size (see, e.g., paragraph [0028]).

The sized catalyst-bearing particles are applied to the inlet wall surface by applying a second slurry containing the sized catalyst-bearing particles and calcining to cause the catalyst-bearing particles to penetrate within the pores of the porous wall to a distance not greater than about 25% of the thickness of the porous wall (see, e.g., paragraphs [0022] and [0027]).

Claim 3 limits the method of claim 1 such that the average composition particle size of the sized catalyst-bearing particles is about 20% to about 50% of the average pore size (see, e.g., paragraph [0028], lines 16-22).

Claim 4 limits the method of claim 3 such that the average composition particle size of the sized catalyst-bearing particles is about 25% to about 35% of the average pore size (see, e.g., paragraph [0028], lines 16-22).

Claim 5 limits the method of claim 1 such that the catalyst composition loading is about 1.2 g/L of substrate volume to about 122 g/L of substrate volume (see, e.g., paragraph [0030], lines 7-9).

Claim 6 limits the method of claim 1 such that the diesel particulate filter has an increase in balance point temperature after aging at 650°C for 50 hours, wherein the increase is less than or equal to about 15°C. (see, e.g., paragraph [0045], lines 15-18).

Claim 7 limits the method of claim 1 such that the diesel particulate filter has an increase in balance point temperature after aging at 700°C for 16 hours in 10% steam, wherein the increase is less than or equal to about 35°C. (see, e.g., paragraph [0045], lines 19-20).

Claim 8 limits the method of claim 1 such that the diesel particulate filter has an increase in balance point temperature after aging at 800°C for 25 hours in 10% steam, wherein the increase is less than or equal to about 70°C. (see, e.g., paragraph [0045], lines 21-23).

Claim 13 limits the method of claim 1 such that the noble metal in the noble metal catalyst used to impregnate the supported promoter particles is platinum or palladium (see, e.g., paragraph [0016], lines 4-6).

Claim 14 is directed to a method for making a diesel particulate filter, involving:

providing a wall-flow substrate having an inlet wall surface and an outlet wall surface (see, e.g., Figure 1 and paragraphs [0026] and [0027]),

applying a promoter oxide compound onto refractory inorganic oxide particles to form supported promoter particles (see, e.g., paragraph [0021]),

impregnating the supported promoter particles with a noble metal catalyst to form catalyst-bearing particles (see, e.g., paragraph [0022]), the noble metal being platinum or palladium (see, e.g., paragraph [0016], lines 4-6),

sizing the catalyst-bearing particles to an average particle diameter of about 2 micrometers to about 10 micrometers (see, e.g., paragraph [0028], the particle size being about 10% to 80% of the average pore size (see, e.g., paragraph [0028], and

applying the sized catalyst-bearing particles to the inlet wall surface of the wall-flow substrate and not to the outlet wall surface (see, e.g., paragraphs [0027] and [0028]).

The wall-flow substrate has an inlet channel, an outlet channel and a porous wall separating the inlet channel and the outlet channel (see, e.g., Fig. 1 and paragraphs [0026] and [0027]).

The porous wall has an inlet wall surface adjacent the inner channel, and an outlet wall surface adjacent the outer channel (see, e.g., Fig. 1 and paragraphs [0026] and [0027]).

The wall-flow substrate is characterized by a thickness between the inlet wall surface and the outlet wall surface and by pores having an average pore size of between 5 micrometers and 500 micrometers (see, e.g., paragraph [0025], lines 7-8).

The promoter oxide compound is applied onto the refractory inorganic oxide particles by forming a first slurry of the refractory inorganic oxide particles dispersed in a solution containing a precursor of the promoter oxide compound and calcining to form the promoter oxide compound, which is then deposited onto the refractory inorganic oxide particles to form the supported promoter particles (see, e.g., paragraph [0021]).

The promoter oxide compound has an element that is vanadium, chromium, manganese, iron, cobalt, copper, zinc, nickel, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, or ytterbium (see, e.g., paragraph [0017], lines 4-12).

The sized catalyst-bearing particles are applied to the inlet wall surface by applying a second slurry containing the sized catalyst-bearing particles and calcining to cause the catalyst-bearing particles to penetrate within the pores of the porous wall to a distance not greater than about 25% of the thickness of the porous wall (see, e.g., paragraphs [0022] and [0027]).

Claim 15 limits the method of claim 14 such that the refractory inorganic oxide is aluminum oxide, doped aluminum oxide, titanium oxide, zirconium oxide, or a combination containing at least one of the foregoing refractory inorganic oxide components (see, e.g., paragraph [0019], lines 5-9).

Claim 16 limits the method of claim 15 such that the refractory inorganic oxide particles are composed of a refractory inorganic oxide which is a delta aluminum oxide, a silica doped aluminum oxide, a lanthanum doped aluminum oxide, or a combination containing at least one of the foregoing refractory inorganic oxides (see, e.g., paragraph [0019], lines 6-7).

## **VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

The following issue is presented for consideration in this appeal:

Whether claims 1, 3-8 and 13-16 are unpatentable under 35 U.S.C. §103(a) as obvious in view of U.S. Patent Application Publication No. 2003/0124037 to Voss et al. ("Voss") taken with Canadian Patent No. 2,299,602 ("the Canadian Patent").

## **VII. ARGUMENTS**

### **Claims 1, 3-8 and 13-16 Would Not Have Been Obvious In View Of Voss Taken With The Canadian Patent**

Diesel particulate filters are characterized by walls having open porosity through which diesel exhaust gases flow. As the exhaust gas passes through the walls, particulate matter (mainly soot) is filtered out onto the walls of the filter, particularly onto the upstream side of the filter walls (i.e., the inlet wall surface). Periodically, the soot deposit is ignited to burn off the deposit and regenerate the filter (referred to as "lightoff"). Catalysts have been used to facilitate this process. Because of the open porosity of the filter wall, solutions tend to penetrate through the wall. Thus, a catalyst applied in solution will be distributed throughout the wall. However, because soot accumulates at the inlet side of the filter, there is a need for the catalyst to be disposed near the inlet side rather than the outlet side of the filter.

In Appellant's claimed methods, a catalyst is applied to the filter such that the catalyst penetrates the pores at the upstream or inlet surface of the filter where the soot tends to accumulate. More specifically, penetration of the catalyst is limited to the region near such upstream or inlet surface of the filter, thereby avoiding wasteful distribution of the expensive catalyst throughout the filter wall, including the downstream or outlet surface of the filter.

Such limited penetration of the filter wall is achieved in the present invention by forming a first slurry of refractory inorganic oxide particles dispersed in a solution containing a precursor of a promoter oxide compound, calcining the first slurry to form the promoter oxide compound and depositing the compound onto the refractory inorganic oxide particles to form supported promoter particles, impregnating the supported promoter particles with a noble metal catalyst to form catalyst-bearing particles, sizing the catalyst-bearing particles to a particular size relative to the average pore size of a wall-flow substrate of the filter, forming a second slurry containing the catalyst-bearing particles, applying the second slurry to an inlet wall surface of the wall-flow substrate and not to an outlet wall surface of the substrate, and calcining the second slurry to cause the catalyst-bearing particles to penetrate within the pores of the porous wall of the substrate.

In Appellant's claimed methods, the catalyst-bearing particles are sized so that the particle size is 10% to 80% of the pore size of the substrate. This permits the particles, when applied in the second slurry, to penetrate the wall of the substrate but remain near the inlet surface to enhance the effectiveness of the catalyst and promoter oxide in regenerating the filter. The particles penetrate the porous wall to a distance not greater than about 25% of the thickness of the wall.

Thus, with Appellant's claimed method, catalyst-bearing particles containing both a promoter oxide and a noble metal penetrate the pores of the substrate's inlet surface but are not distributed at the substrate's outlet surface. Another advantage achieved with Appellant's claimed method is that the catalyst-bearing particles formed therein have a uniform composition.

Appellant respectfully submits that the methods set forth in instant claims 1, 3-8 and 13-16 would not have been obvious in view of Voss taken with the Canadian Patent.

Voss is cited for its disclosures regarding a diesel particulate filter, while the Canadian Patent is cited for its teachings of a method of making a catalytic material.

Voss is said to read upon the instant claims regarding the provision of a wall-flow substrate and the catalyst applied thereto. However, Voss teaches that "the catalytic material is applied as a thin coating or coatings to a suitable carrier" (paragraph [0075]). As noted above, the catalyst-bearing particles in Appellant's claimed method penetrate the pores of the substrate. Voss does not teach or suggest this feature.

According to the Final Office Action, the recitation in claim 1 “to cause said catalyst-bearing particles to penetrate within the pores of the porous wall to a *distance not greater than about 25%* of the thickness of the porous wall”, encompasses a distance of zero (0) percent penetration, which the Office Action characterizes as “that disclosed by the prior art”. The Office Action further states that “in the mere application of the catalyst to the surface of the carrier, penetration of the catalyst into said surface is expected to some extent”.

Appellant respectfully submits that a fair reading of the language in claims 1 and 14 is that the catalyst-bearing particles penetrate within the pores of the porous wall and this penetration is limited to a recited portion of the wall, i.e., no more than about 25%. Nothing in claim 1, claim 14, the other claims or the specification suggests that penetration of the catalyst-bearing particles into the pores of the wall is optional. In addition, the specification teaches that when the particle size of the solids in the catalyst slurry (i.e., the second slurry in claims 1 and 14) is about 10% to about 80% of the average pore size of the substrate (as recited in claims 1 and 14), “desired catalyst distribution with regard to the inlet wall surface” of the substrate is achieved (see paragraph [0028]). In other words, based on the stated relationship between the particle size of the solids in the second slurry and the average pore size of the substrate in claims 1 and 14, penetration occurs in the methods as recited in claims 1 and 14.

As noted above, the Final Office Action alternatively states that “in the mere application of the catalyst to the surface of the carrier, penetration of the catalyst into said surface is expected to some extent”. Even assuming, for the sake of discussion, that particles in Voss do penetrate into the pores of the substrate, some of the pores will contain ceria particles and some pores will contain other metal oxide particles. This is because the slurry in Voss contains ceria particles and other metal oxide particles optionally impregnated with platinum or palladium (paragraph [0071]), and the slurry is then applied to the carrier, dried and calcined to form a catalytic material coating on the substrate.

In contrast, in Appellant’s claimed methods, the slurry containing refractory inorganic oxide particles dispersed in a solution containing a precursor of the promoter oxide compound (the first slurry) is calcined to form the promoter oxide compound and deposit the promoter oxide compound onto the refractory inorganic oxide particles, thereby forming supported promoter particles. Thus, in Appellant’s claimed methods, because the supported promoter particles contain the promoter oxide compound deposited onto the refractory inorganic oxide

particles, each particle that penetrates the pores of the substrate includes the promoter oxide, e.g., cerium oxide.

Voss does not teach or suggest depositing the cerium compound onto the metal oxide particles nor does it teach or suggest applying a slurry in which all of the particles include cerium oxide. Nothing in Voss would have led one skilled in the art to apply the promoter oxide to the refractory inorganic oxide particles so as to obtain uniform distribution of promoter oxide within the pores of the substrate by the slurry.

The Final Office Action acknowledges that Voss does not teach or suggest the method steps recited in instant claim 1. The Canadian patent is cited for disclosing a method for preparing a catalyst material. The Canadian patent is also cited for teaching that the catalyst material therein can be used for the treatment of exhaust gases from internal combustion engines. According to the Office Action, it would have been obvious to modify the Voss teachings to incorporate therein the method taught in the Canadian patent because “the apparatus comprising the wall-flow substrate disclosed in Voss et al. is suitable for the treatment of waste gas streams such as internal combustion exhaust”.

The Office Action acknowledges that both Voss and the Canadian patent teach that the catalytic materials therein are applied to the substrate as a coating. In addition, the Office Action notes that Voss does not disclose the step of sizing the particles to an average diameter of 2 to 10 micrometers or to a size that is 10% to 80% of the average pore size of the substrate. The Office Action relies on the Canadian patent for this teaching. The Canadian patent does not expressly teach sizing the particles to a size that is 10% to 80% of the average pore size of the substrate. According to the Examiner, because the Canadian patent teaches a catalyst material comparable to the catalyst-bearing particles in Appellant’s claim 1 method, “one skilled in the art would readily deduce that the prior art particles having a size comparable to Applicant’s ‘catalyst-bearing particles’ would also exhibit an average pore size reading upon ‘about 10% to about 80% of the average pore size.’” Appellant respectfully disagrees with this assertion, for the reasons discussed below.

In Appellant’s claimed method, the sizing of the catalyst-bearing particles to a particle size that is about 10% to about 80% of the average pore size is carried out so that the particles will penetrate within the pores of the wall of the substrate. The catalytic material prepared in the Canadian patent is not intended to penetrate the pores of the substrate wall. Although not



expressly shown therein, the substrate disclosed in the Canadian patent comprises longitudinal channels through which exhaust gas flows from the inlet end to the outlet end without flowing through the walls of the substrate. This is in marked contrast with Appellant's diesel particulate filter wherein the exhaust gas is forced through the porous walls. In the substrate disclosed in the Canadian patent, catalytic activity occurs from the interaction with the catalyst on the surface of the channel. The catalytic material is not intended or formulated to impregnate the substrate. Appellant submits that one skilled in the art would appreciate that the catalyst in the Canadian patent would need to be applied as a layer on the surface of the channel in the substrate so as to maximize contact with the exhaust gas, i.e., not be buried within pores beneath the surface. Thus, the Canadian patent does not teach or suggest a catalytic material formulation that is intended to penetrate porosity of a substrate for a diesel particulate filter.

The Office Action acknowledges that the Canadian patent, like Voss, teaches that the catalytic material therein is applied to the substrate as a coating. Because the catalytic material prepared in the Canadian patent is not intended to penetrate the pores of the substrate wall, there is no reason to size the particles therein so that they will penetrate the pores of the substrate wall. In other words, there is no reason in the Canadian patent to size the particles to a size that is 10% to 80% of the average pore size. Thus, Appellant submits that one skilled in the art would **not** readily induce that the prior art particles having a size comparable to Applicant's 'catalyst-bearing particles' would also exhibit an average pore size reading upon 'about 10% to about 80% of the average pore size', as asserted in the Office Action.

Therefore, the Canadian Patent does not teach sizing the catalytic particles therein to a size that is 10% to 80% of the average pore size of a substrate, particularly a substrate configured for use in a diesel particulate filter.

Thus, Voss and the Canadian patent do not in combination teach or suggest a method of making a diesel particulate filter involving forming the sized catalyst-bearing particles described in the instant claims and applying such particles to the inlet wall surface of the wall-flow substrate and not to the outlet wall surface, wherein the catalyst-bearing particles are caused to penetrate within the pores of the porous substrate wall to a distance not greater than 25% of the wall thickness.

Therefore, for at least the reasons given above, Appellant respectfully submits that claims 1, 3-8 and 13-16 would not have been obvious over Voss taken with the Canadian Patent.

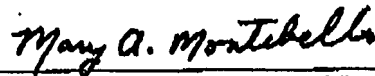
\* \* \* \* \*

For the reasons set forth above, Appellant respectfully requests that the rejection under 35 U.S.C. §103(a) be reversed.

If any additional fees under 37 C.F.R. §§ 1.16 or 1.17 are due in connection with this filing, please charge the fees to Deposit Account No. 02-4300, Order No. 034166.058.

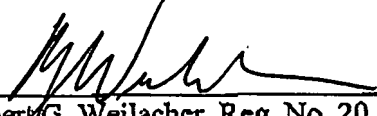
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Dated: *November 19, 2007*  
RGW/MM/cj

**VIII. APPENDIX**

Pursuant to 37 CFR 1.192(c)(9), herein is a clean copy of claims 1, 3-8 and 13-16, the claims involved in this appeal.

Claim 1 (Previously Presented): A method for making a diesel particulate filter, comprising:

providing a wall-flow substrate comprising an inlet channel and an outlet channel and a porous wall separating the inlet channel and the outlet channel, said porous wall comprising an inlet wall surface adjacent the inlet channel and an outlet wall surface adjacent the outlet channel, said wall-flow substrate being characterized by a thickness between the inlet wall surface and the outlet wall surface and by pores having an average pore size between 5 micrometers and 500 micrometers;

applying a promoter oxide compound onto refractory inorganic oxide particles by forming a first slurry of the refractory inorganic oxide particles dispersed in a solution containing a precursor of the promoter oxide compound and calcining to form the promoter oxide compound and deposit the promoter oxide compound onto the refractory inorganic oxide particles, thereby forming supported promoter particles;

impregnating the supported promoter particles with a noble metal catalyst to form catalyst-bearing particles;

sizing the catalyst-bearing particles to an average particle diameter of about 2 micrometers to about 10 micrometers, wherein the particle size is about 10% to about 80% of the average pore size;

applying the sized catalyst-bearing particles to the inlet wall surface of the wall-flow substrate and not to the outlet wall surface, said catalyst-bearing particles being applied by applying a second slurry comprising the sized catalyst-bearing particles and calcining to cause said catalyst-bearing particles to penetrate within the pores of the porous wall to a distance not greater than about 25% of the thickness of the porous wall.

Claim 2 (Cancelled)

Claim 3 (Previously Presented): The method of Claim 1, wherein the average composition particle size is about 20% to about 50% of the average pore size.

Claim 4 (Previously Presented): The method of Claim 3, wherein the average composition particle size is about 25% to about 35% of the average pore size.

Claim 5 (Original): The method of Claim 1, wherein the catalyst composition loading is about 1.2 g/L of substrate volume to about 122 g/L of substrate volume.

Claim 6 (Previously Presented): The method of Claim 1, wherein the diesel particulate filter has less than or equal to an about 15°C increase in a balance point temperature after aging at 650°C for 50 hours.

Claim 7 (Previously Presented): The method of Claim 1, wherein the diesel particulate filter has less than or equal to an about 35°C increase in a balance point temperature after aging at 700°C for 16 hours in 10% steam.

Claim 8 (Previously Presented): The method of Claim 1, wherein the diesel particulate filter has less than or equal to an about 70°C increase in a balance point temperature after aging at 800°C for 25 hours in 10% steam.

Claims 9-12 (Cancelled)

Claim 13 (Previously Presented): The method of Claim 1, wherein the noble metal is selected from the group consisting of platinum and palladium.

Claim 14 (Previously Presented): A method for making a diesel particulate filter, comprising:

providing a wall-flow substrate comprising an inlet channel and an outlet channel and a porous wall separating the inlet channel and the outlet channel, said porous wall comprising an inlet wall surface adjacent the inlet channel and an outlet wall surface adjacent the outlet

channel, said wall-flow substrate being characterized by a thickness between the inlet wall surface and the outlet wall surface and by pores having an average pore size between 5 micrometers and 500 micrometers;

applying a promoter oxide compound onto refractory inorganic oxide particles by forming a first slurry of the refractory inorganic oxide particles dispersed in a solution containing a precursor of the promoter oxide compound and calcining to form the promoter oxide compound and to deposit the promoter oxide compound onto the refractory inorganic oxide particles, thereby forming supported promoter particles, wherein the promoter oxide compound comprises an element selected from the group consisting of vanadium, chromium, manganese, iron, cobalt, copper, zinc, nickel, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, and ytterbium;

impregnating the supported promoter particles with a noble metal catalyst to form catalyst-bearing particles, said noble metal being selected from the group consisting of platinum and palladium;

sizing the catalyst-bearing particles to an average particle diameter of about 2 micrometers to about 10 micrometers, wherein the particle size is about 10% to about 80% of the average pore size;

applying the sized catalyst-bearing particles to the inlet wall surface of the wall-flow substrate and not to the outlet wall surface, said catalyst-bearing particles being applied by applying a second slurry comprising the sized catalyst-bearing particles and calcining to cause said catalyst-bearing particles to penetrate within the pores of the porous wall to a distance not greater than about 25% of the thickness of the porous wall.

Claim 15 (Previously Presented): The method of Claim 14, wherein the refractory inorganic oxide particles are composed of a refractory inorganic oxide selected from the group consisting of aluminum oxide, doped aluminum oxide, titanium oxide, zirconium oxide, and a combination comprising at least one of the foregoing refractory inorganic oxide components.

Claim 16 (Previously Presented): The method of Claim 15, wherein the refractory inorganic oxide particles are composed of a refractory inorganic oxide selected from the group

consisting of delta aluminum oxide, silica doped aluminum oxide, lanthanum doped aluminum oxide, and a combination comprising at least one of the foregoing refractory inorganic oxide components.

Claims 17-26 (Cancelled)

**IX. EVIDENCE APPENDIX**

No declarations or affidavits under 37 CFR 1.130, 1.131 or 1.132 were submitted.

**X. RELATED PROCEEDINGS APPENDIX**

There have been no decisions rendered in any related appeals or interferences.